MODIFIED ASTROLABE

After a note by Professor G. B. PACELLA,
Geographical Engineer of the Military Geographical Institute, Florence,
published in Universo, *Florence, September-October,* 1947.

Professor Pacella here develops a method which he has adopted, by which the results of observations made with the prismatic astrolabe may be improved, reducing the number of stars to be observed for a given station, which subsequently affords an appreciable speeding-up of operations.

He notes that if, instead of obtaining only one sight for each star (corresponding to the time when the two images of the star are seen to coincide in the field of the telescope), several sights of similar accuracy could be obtained, the average of these sights will obviously improve the observation results for each star.

For this purpose, Professor Pacella arranges in the focal plan of the objective, a reticle fitted with horizontal hairlines and, in addition to the time of contact of the two images, observes the times when the images successively intersect the hairlines of the reticle.

To understand the working of the system, let us assume the simple case of a reticle consisting of a single hairline situated underneath (or above) the coincidence point of the images (fig. 1). If O represents this point and f the reticle hairline assumed to be rectified. i.e. horizontal, it is obvious that the two tracks AO and OA' are equal and by averaging the times of transit of each image on the hairline f, the time when the two images coincide in O is obtained.

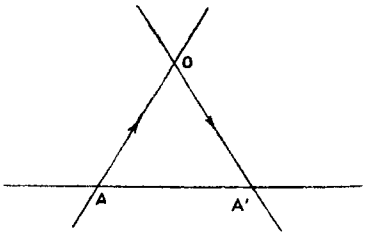

FIG. 1

If *several* horizontal hairlines are arranged, all underneath or all above the point of coincidence, each of them will enable us to calculate a value for the time of coincidence.

The reticle adopted by the author consists of 8 horizontal observation hairlines, all situated in the upper part of the field, and of four others, two horizontal and two vertical, forming a limitary quadrilateral inscribed in the circular field of the objective.

It should, however, be noted that the angle of resection of the tracks of the images of a star when crossing a horizontal hairline is equal to the azimuthal angle of the celestial body, i.e. 90° for a star in the prime vertical and 0° for meridian stars. Consequently, while stars observed in the prime vertical or its vicinity intersect all the hairlines of the reticle, those observed in the vicinity of the meridian enter in the field with nearly horizontal tracks and do not intersect any of them. Stars the azimuth of which is between the above two extremes intersect only some of the horizontal hairlines.

The insertion of the reticle improves the homogeneity of the observations and by multiplying the sights on each star enables the amount of calculation to be diminished.

If, however, the images of the hairlines are not exactly horizontal, the average of the times of transit of the two images on the same hairline does not correspond to the time of

coincidence of the two images, as is easily demonstrated. For this reason the author has constructed a reticle consisting of two co-axial annular crowns which may be pivoted around the centre, and therefore rectifiable (fig. 2) by manoeuvring a slow-motion screw so that two images of a star of intercardinal azimuth transit simultaneously the vertical hairline at the exit from the telescope field.

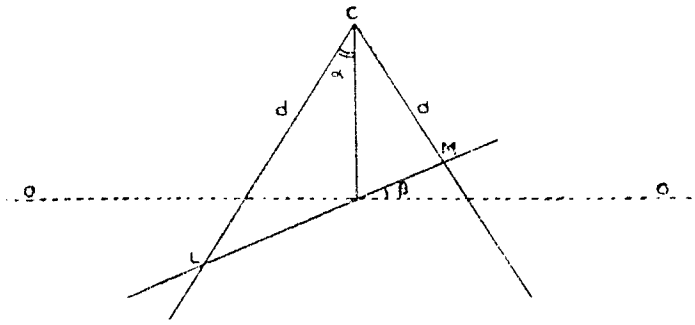

FIG. 2

In conclusion, the author develops a few considerations concerning the possibility of eliminating the influence of residual error in the adjustment of the reticle, i.e. in the horizontality of the hairlines, by using another type of reticle with optical illumination of the hairlines.

He notes that if a reticle is fitted with a hairline in the upper part of the field and another in the lower part, equally distant from the point at which the two images coincide, and if those two hairlines are of equal degree of inclination with reference to the horizontal, the error when observing the star on the upper hairline is equal but of opposite sign to that

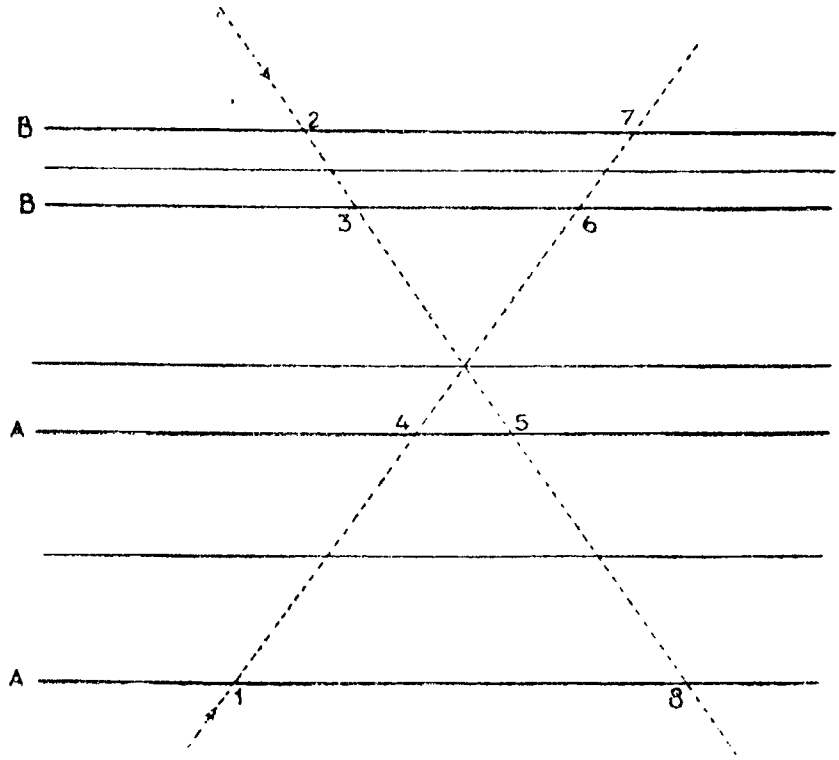

FIG. 3

made when observing the same star on the lower hairline. He proposes the following solution: (fig. 3).

To observe the two images of the same star in transit on couples of hairlines (such as AA and BB - fig. 3) diversely separated but with their bisectors distributed on either side of the point at which the coincidence of the images takes place and in the following sequence : 1, 2, 3, 4, 5, 6, 7, 8.

The appropriate use of this additional reticle is likely to diminish the influence of accidental observation errors by multiplying the number or sights taken on each star.